

**REMARKS**

Claims 1-4, 7-9, 11-16, 18-21, 24-25, 27-28, and 30-39 are pending in the application. Claim 40 is added. Claims 1-4, 7-9, 11-16, 18-21, 24-25, 27-28, and 30-39 stand rejected. Claims 1, 24, and 38 are independent claims.

***New Claim***

Claim 40 is added. Support for claim 40 can be found in previously presented claim 36. Entry of the claim is respectfully requested.

***35. U.S.C. §102(b) Rejection on Claims 1 and 38 Over U.S. 5,567,268***

Claim 1 stands rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Kadomura (U.S. 5,567,268) ("Kadomura '268 patent").

Claim 1 recites, *inter alia*, "an RF antenna unit including an active antenna and a parasitic antenna, ... the parasitic antenna surrounding the plasma chamber, wherein the parasitic antenna is not electrically coupled to the RF source; and ... wherein each antenna of the RF antenna unit resonates RF current and induces electro-magnetic field that is effective to pass into the plasma chamber and that excites and ionizes the process gas to generate a plasma within the plasma chamber, the plasma comprising ions."

According to the United States Court of Appeals for the Federal Circuit, a claim is anticipated only if a single prior art reference set forth each and every feature recited in the claim (*Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987)). Anticipation may still exist even if the prior art reference does not expressly set forth each and every feature under the doctrine of inherency (see *Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 20 USPQ2d 1746, 1749-50 (Fed. Cir. 1991)). However, the missing feature **must be necessarily present** in the feature (id.). **"Inherency [] may not be established by probabilities**

or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient” (*In re Oelrich*, 666 F.2d 578, 581, 212 USPQ 323, 326 (C.C.P.A. 1981)). Moreover, if the rejection is based on inherency, “it is incumbent on the [Patent Office] to point to the ‘page and line’ of the prior art which justifies an inherency theory” (*Ex parte Schricker*, 56 USPQ2d 1723 (B.P.A.I. 2000) (unpublished)).

Although the Patent Office acknowledges that nowhere in Kadomura `268 patent is there a disclosure that the loop 22 is a parasitic antenna, the Patent Office rejects claim 1 (present Office Action, page 14, line 5-16). To support the rejection, the Patent Office indicates that “inducing RF current into the plasma chamber is an inherent result of the loop antenna not being connected to the power source” (id.).

Applicants respectfully submit that Kadomura `268 patent fails to set forth the parasitic antenna. According to the patent, the loop antenna 22 is configured to generate helicon plasma. However, nowhere in Kadomura `268 patent is there an explicit or implicit disclosure that the loop antenna 22 induces RF current when it is not electrically connected to the RF power. On the contrary, the patent explicitly states that it only contains antennas that induce RF current only when they are electrically connected to and powered by the RF current source (column 7, line 19-41). In particular, Kadomura `268 patent contains explicit teachings that the loop 22 does not induce RF current when it is not electrically connected to the RF power. The loop 22 does not generate helicon plasma (i.e. does not induce RF current) when the switch 35 is turned OFF such that the loop 22 is not electrically connected to the RF power 39 (id., column 7, line 36-41). Further, Applicants believe that the grounded top board 24 magnetically shields the loop 22. For example, the magnetic field from the multi-turn coil 31 will be short circuited to the ground by the grounded top board 24 such that the loop 22 will not encounter the magnetic field from the multi-turn coil 31.

As such, the loop 22 is prevented from inducing the RF current when it is not electrically coupled to the RF power source. The loop 22 is inherently, not a parasitic coil.

Kadomura '268 patent, therefore, patent fails to set forth "an RF antenna unit including an active antenna and a parasitic antenna, ... the parasitic antenna surrounding the plasma chamber, wherein the parasitic antenna is not electrically coupled to the RF source; and ... wherein each antenna of the RF antenna unit resonates RF current and induces electro-magnetic field that is effective to pass into the plasma chamber and that excites and ionizes the process gas to generate a plasma within the plasma chamber, the plasma comprising ions," as recited in claim 1.

Applicants respectfully request withdrawal of rejection on claim 1.

Claim 38 stands rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Kadomura '268 patent.

Claim 38 recites "an RF antenna unit including a horizontally-extending active antenna coil and a vertically extending parasitic antenna coil, the horizontally-extending active antenna coil that includes a first end coupled to the RF source to receive the RF current from the RF source, the vertically-extending parasitic antenna coil being without an electrical connection to a power source... wherein the vertically-extending parasitic antenna coil induces an RF current into the plasma chamber and excites and ionizes a process gas so as to generate a plasma in the plasma chamber, the plasma comprising ions."

Applicants believe that claim 38 recites similar features as those in claim 1. Thus, claim 38 is patentable over Kadomura '268 patent on the similar grounds.

Applicants respectfully request withdrawal of the rejection.

**35. U.S.C. §102(b) Rejection on Claim 38 Over U.S. 6,096,160**

Claim 38 stands rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Kadomura (U.S. 6,096,160) (“Kadomura `160 patent”).

Claim 38 recites “an RF antenna unit including a horizontally-extending active antenna coil and a vertically extending parasitic antenna coil, ... **the vertically-extending parasitic antenna coil being without an electrical connection to a power source**... wherein the vertically-extending parasitic antenna coil induces an RF current into the plasma chamber and excites and ionizes a process gas so as to generate a plasma in the plasma chamber, the plasma comprising ions.”

In rejecting claim 38, the Patent Office indicates that the solenoid coil 53a, 53b of Kadomura `160 patent can be considered vertically extending (present Office Action, page 14, line 18-21), thus identical to the vertically extending parasitic antenna coil of claim 38 (id., at page 4, line 6-7). In addition, the Patent Office indicates that “inducing RF current into the plasma chamber is an inherent result of the loop antenna not being connected to the power source” (id., at page 14, line 21 – page 15, line 5).

Kadomura `160 patent, as read by Applicants, discloses helicon wave plasma processing apparatus comprising a plasma source. The apparatus includes, among others, a bell jar 51, a loop antenna 52 encircling the bell jar 51; a solenoid coil 53 mounted for encircling the bell jar 51, and a grounded upper lid 56 (FIG. 4-6). According to Kadomura `160 patent, “the solenoid coil 53 is of a dual structure and is comprised of an inner solenoid coil 53a and an outer solenoid coil 53b (column 9, line 31-35). As shown in FIG. 4-6, the loop antenna 52 is disposed between the solenoid coil 53a and 53b and the bell jar 51, and the grounded upper lid 56 is disposed between the solenoid coil 53a and 53b and the processing chamber 57.

Applicants respectfully submit that the solenoid coil 53a or 53b, as disclosed in Kadomura '160 patent, is not identical to the vertically extending parasitic antenna coil of claim 38. First, as noted in Appendix A, “[a] solenoid coil is a long wire wound in a close-packed helix and carrying a current *i*” (David Halliday & Robert Resnick, *Physics*, 755-757, (3d ed. 1978)). To generate magnetic field, current must flow through the coil (see id, at 757 (stating that the magnetic field is proportional to the current flowing through the coil)). As noted in to Kadomura '160 patent, if the switch 67 electrically connecting the solenoid coils 53a and 53b to the power source 68 is turned OFF, and as the coils 53a and 53b are not electrically coupled to the power source 68, “there is produced no magnetic field in the bell jar 51, such that no helicon wave plasma is generated” (column 10, line 66 – column 11, line 2). Accordingly, solenoid coils 53a and 53b do not appear to resonate RF current into the plasma chamber and excites and ionizes a process gas so as to generate a plasma in the plasma chamber if it is not electrically coupled to a power source.

The solenoid coils 53a and 53b, therefore, is not inherently the parasitic coil of claim 38. As such, Kadomura '160 patent fail to set forth the vertically-extending parasitic coil of claim 38. In other words, Kadomura '160 patent fails to set forth “an RF antenna unit including a horizontally-extending active antenna coil and a vertically extending parasitic antenna coil. ... **the vertically-extending parasitic antenna coil being without an electrical connection to a power source...** wherein the vertically-extending parasitic antenna coil induces an RF current into the plasma chamber and excites and ionizes a process gas so as to generate a plasma in the plasma chamber, the plasma comprising ions,” as set forth in claim 38. Kadomura '160 patent fails to anticipate claim 38.

Applicants respectfully request withdrawal of the rejection.

**35. U.S.C. §103(a) Rejection on Claim 24 Over U.S. 6,096,160**

Claim 24 stands rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Kadomura '268 patent in view of Trow *et al.* (U.S. 5,824,607) ("Trow") in view of Collins *et al.* (U.S. 5,556,501) and one of Denholm *et al.* (U.S. 5,911,832) ("Denholm") or Tezuka (U.S. 4,771,730).

Claim 24 recites, *inter alia*, "a radio frequency antenna unit including a horizontally-extending coil... and a vertically-extending coil disposed on the vertical cylindrical dielectric section..., wherein... one of the horizontally-extending coil and the vertically-extending coil comprises a parasitic antenna that is not electrically coupled to the RF source... [and] the parasitic antenna of the radio frequency antenna unit inducing radio frequency current into the plasma chamber that excites and ionizes a process gas so as to generate a plasma in the plasma chamber."

As noted in section 2143(A) of the Manual for Patent Examining Procedure ("MPEP"), a rejection of a claim as obvious cannot be sustained unless the Patent Office establishes that one or more references teach all features recited in the claim, "with the only difference between the [feature] and [one or more references] being lack of actual combination of the [feature] in a single [] reference." A claim may be rejected under section 103 even if a feature that is missing from one or more references is inherent. However, the United States Court of Customs and Patent Appeal stated that "[t]hat which may be inherent is not necessarily known. Obviousness cannot be predicated on what is unknown" (*In re Spormann*, 363 F.2d 444, 150 USPQ 449, 452, (C.C.P.A. 1966)). The Federal Circuit also stated that "To imbue one of ordinary skill in the art with knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome where that which only the

inventor taught is used against its teacher” (*W. L. Gore & Associates v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983)).

In rejecting claim 24, the Patent Office indicates that the coil 31 of Kadomura `268 patent is parasitic antenna that induces RF current to ionize a process gas even if it is not electrically coupled to the RF source (present Office Action, page 10, line 3-15). The Patent Office acknowledges that the patent does not teach the parasitic antenna. However, according to the Patent Office, the feature is inherent (*id.*, at page 14, line 5 – page 15, line 10).

As noted earlier, nowhere in Kadomura `268 patent (or Kadomura `160 patent) is there a disclosure of a parasitic antenna that is without an electrical connection to the RF power supply and that induces RF current into the plasma chamber that excites and ionizes a process gas so as to generate plasma in the plasma chamber. Moreover, nowhere in the patent (or Kadomura `160 patent) is there a suggestion that the parasitic antenna is inherently disclosed. Further, the Patent Office has not established that the parasitic antenna is inherently disclosed. The present rejection, therefore, cannot be sustained unless at least one of Trow, Collins, Denholm, and Tezuka teaches the missing feature and remedies the deficiencies of Kadomura `268 patent (or Kadomura `160 patent). Otherwise, none of Kadomura `268 patent (or Kadomura `160 patent), Trow, Collins, Denholm, and Tezuka, even if combined, teaches a system that lacks the feature of claim 24, and the combination of such references does not render claim 24 obvious. Applicants respectfully submit that a feature that is missing from each and every reference does not materialize by simply combining the references.

As noted in the response to earlier Office Action, none of Trow, Collins, Denholm, and Tezuka teaches the parasitic antenna. In particular, each of Trow and Collins teaches coil 30 that is each electrically coupled to the power source 31 (FIG. 1 of Trow and Collins). Each does not teach a

coil that is not electrically coupled to the power source, much less a parasitic coil that is not electrically coupled to RF power source and that induces RF current to the plasma. Meanwhile, each of Denholm and Tezuka appears to disclose a system comprising electrodes 30 and 32 (Denholm FIG. 1), and electrode 5 and 6 (Tezuka FIG. 1), that ionizes the processing gas.

Accordingly, each of Trow, Collins, Denholm, and Tezuka fails to teach “a radio frequency antenna unit including a horizontally-extending coil... and a vertically-extending coil disposed on the vertical cylindrical dielectric section..., wherein... one of the horizontally-extending coil and the vertically-extending coil comprises a parasitic antenna that is not electrically coupled to the RF source... [and] the parasitic antenna of the radio frequency antenna unit inducing radio frequency current into the plasma chamber that excites and ionizes a process gas so as to generate a plasma in the plasma chamber.” as recited in claim 24, and none of Trow, Collins, Denholm, and Tezuka remedies the deficiencies of Kadomura '268 patent (or Kadomura '160 patent). As each of Kadomura '268 patent (or Kadomura '160 patent), Trow, Collins, Denholm, and Tezuka fails to teach the parasitic antenna of claim 24, the combination of such references also fail to teach the parasitic antenna of claim 24. Claim 24, therefore, is patentable over Kadomura '268 patent (or Kadomura '160 patent) Trow, Collins, Denholm, and Tezuka, along or in combination.

Applicants respectfully request withdrawal of the rejection.

Further, Applicants respectfully submit that Tomioka *et al.* (U.S. 5,897,713) (“Tomioka”), although not cited in the present Office Action, neither anticipates nor render claims 1, 24, and 38 obvious. Tomioka also fails to teach the parasitic antenna of claims 1, 24, and 38.

Tomioka, as read by Applicants, discloses a number of different plasma generating systems (see FIG. 1, 4, 8, 10, 12, 13, 15, and 14) comprising multiple RF antennas. In the system illustrated in FIG. 1, Tomioka discloses that the system comprises first coil 3 and second coil 4. However,



Tomioka explicitly discloses that the first coil 3 is electrically connected to the RF power supply 7, whereas the second coil 4 is electrically coupled to the RF power supply 7 (column 5, line 40-45). In the system illustrated in FIG. 4, a first flat spiral coil 32 is electrically coupled to the RF power supply 7, whereas the second flat spiral coil 33 is electrically coupled to the RF power supply 10 (column 8, line 24-30).

In the system illustrated in FIG. 8, the first coil 55a is electrically coupled to the RF oscillator 56 via the RF power amplifier 57a, whereas the second coil 55a is electrically coupled to the RF oscillator 56 via the RF power amplifier 57b (column 9, line 30-36). The system disclosed in FIG. 10 comprises one additional coil, a third coil 55c. However, the third coil 55c is also electrically connected to the RF oscillator 56 via the RF power amplifier 57c (column 11, line 29-39). In the system illustrated in FIG. 12, the system comprises four coils 55a-55d. Tomioka explicitly states “[t]he respective coils 55a to 55d are respectively [electrically] connected to RF power supplies 57a to 57d” (column 14, line 25-27).

In the system illustrated in FIG. 13, the first coil 55a is electrically coupled to the RF power supply 57a, whereas the second coil 55b is electrically coupled to the RF power supply 57b (column 15, line 23-31). The system disclosed in FIG. 14, meanwhile, comprises first to fifth coils 134, 135, 136, 137, and 138. Each of the coils 134, 135, 136, 137, and 138, however, is electrically connected to RF power supply 140 via RF power supply controller 139 (column 16, line 28-34). Finally, the system illustrated in FIG. 15 comprises a single coil that is coupled to an RF power supply 204 (column 1, line 51-53).

Accordingly, Tomioka discloses a plasma generating apparatus comprising one or more coils. However, Tomioka explicitly teaches that **each of the coils is electrically coupled to an RF power supply**. Accordingly, nowhere in Tomioka is there a disclosure of a parasitic antenna or coil recited

in claims 1, 24, and 38. Tomioka, therefore, does not anticipate claims 1, 24, and 38. Moreover, Tomioka, even if combined with the reference discussed earlier, does not render claims 1, 24, and 38 obvious as the combination also fails to teach the parasitic antenna of claims 1, 24, and 38.

Accordingly, Applicants respectfully request early passage of the claims.

Other claims in consideration are each dependent on the independent claims 1, 24, and 38, and believed to be patentable for the same reasons. Since each dependent claims is also deemed to define other aspects of the invention, individual consideration of the patentability of each on its own merit is respectfully requested.

Should the Examiner deem that there is any issue which may be best resolved by telephone, the Examiner is respectfully requested to contact the representative undersigned below. Please charge any additional fees or credit any overpayments to deposit account No. 50-0896.

Respectfully submitted,  
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